REMARKS

Applicants respectfully request reconsideration of the subject application as amended herein. This Amendment is submitted in response to the Non-Final Office Action mailed on October 28, 2008. Claims 8-30 are rejected. In this Amendment, claims 8, 13, 16, 18, 23 and 24 have been amended. No claims have been canceled. New claims 31-38 have been added. Therefore, claims 8-38 are presented for examination.

Rejections Under 35 U.S.C. § 103

Claims 8-30 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Grzeszczuk et al. (U.S. Patent No. 6,782,287 B2, hereafter "Grzeszczuk") in view of Bova et al., (U.S. Patent No. 5,954,647, hereinafter "Bova").

As amended, claim 8 recites:

> A method in image guided radiosurgery for aligning the position of a treatment target relative to a radiosurgical beam generator during treatment, the method comprising:
>
> a. generating a pre-treatment 3D scan showing an initial position of said target at treatment planning time;
>
> b. generating a set of 2D reconstructed images from said 3D scan, **wherein the set of 2D reconstructed images corresponds to perturbations from said initial position along fewer than six degrees of freedom**;
>
> c. generating at near real time one or more 2D x-ray images of said target, wherein said x-ray images show a current position of said target at a current time during treatment;
>
> d. registering said reconstructed images with said x-ray images by computing a set of 3D transformation parameters that represent the change in position of said target between said 3D scan and said x-ray images, wherein said 3D transformation parameters are 3D rigid body transformation parameters, and wherein said 3D transformation parameters are represented by three translations and three rotations *(x, y ,z, r, p, w)*; wherein *x, y, z* represent the translations of said target in the directions of three mutually orthogonal axes, respectively, and wherein *r, p,* w represent three rotations (roll, pitch, yaw) about said three orthogonal axes; and
>
> e. in near real time, adjusting the relative position of said radiosurgical beam generator to said target by the amount prescribed by said 3D transformation parameters computed in step d, **wherein said target is allowed six degrees of freedom of position**.

(emphasis added).

Grzeszczuk teaches registering a CT scan (3D scan) with a pair of 2D x-ray images (fluoroscopic images). (Grzeszczuk, col. 7, lines 5-7). Grzeszczuk teaches three different techniques for performing this registration. (Grzeszczuk, col. 7, lines 37-57). Grzeszczuk teaches a first technique, in which a single reference image is taken, and then rotated and translated to find a best fit. (Grzeszczuk, col. 7, lines 38-44). However, this first technique is not capable of handling registration for out of plane degrees of freedom, and therefore **does not allow six degrees of freedom of position**. (Grzeszczuk, col. 7, lines 49-52).

Grzeszczuk teaches a second technique that consists of calculating a set of reference DRRs that samples a full range of possible patient positions and orientations, and then making an interpolative comparison with an acquired fluoroscopic image with each of the DRRs. (Grzeszczuk, col. 7, lines 44-49). However, this second technique is also not capable of handling registration for out of plane degrees of freedom, and therefore **also does not allow six degrees of freedom of position**. (Grzeszczuk, col. 7, lines 49-52).

Finally, Grzeszczuk teaches a third technique that interactively re-projects digitally reconstructed radiographs of the 3D scan data while perturbing the pose of a patient in the 3D scan data. (Grzeszczuk, col. 7, lines 52-57). In this technique, the 3D scan data is perturbed in six degrees of freedom. With each perturbation of the 3D scan data, reconstructed images corresponding to the perturbation are generated. If the reconstructed images match the x-ray images, then the registration parameters are determined. If the reconstructed images do not match the x-ray images, the 3D scan data is perturbed in the six degrees of freedom again. Though the third technique of Grzeszczuk is capable of measuring six degrees of freedom, it does so by **perturbing the pose of the patient in all six degrees of freedom**. The third technique does not generate DRRs that **corresponded to patient perturbations along fewer than six degrees of freedom.**

In contrast to Grzeszczuk, claim 8 recites, "generating a set of 2D reconstructed images ... correspond[ing] to perturbations from said initial position along fewer than six degrees of freedom." Claim 8 also recites, "wherein said target is allowed six degrees of freedom of position." Accordingly, Grzeszczuk fails to teach or suggest all of the limitations of independent claim 8.

The invention as claimed in claim 8 can achieve image registration in all six degrees of freedom using 2D reconstructed images that correspond to perturbations from the initial position along fewer than six degrees of freedom, which is not taught or suggested by Grzeszczuk. By generating 2D reconstructed images that correspond to perturbations from an initial position along fewer than six degrees of freedom, the number of computations that it takes both to generate reconstructed images and to register the reconstructed images with x-ray images is reduced. Thus, the invention of claim 8 provides a computational reduction over the image registration techniques of Grzeszczuk.

Bova teaches a system for locating a target during radiation treatment that uses a bite plate to facilitate the locating. (Bova, Abstract). However, Bova fails to teach or suggest "generating ... 2D reconstructed images correspond[ing] to perturbations from said initial position along fewer than six degrees of freedom." Therefore, Bova fails to teach or suggest the features of claim 8 that are missing from Grzeszczuk.

For the above reasons, Applicants respectfully submit that claim 8 and its dependent claims are patentable over the combination of Grzeszczuk and Bova.

Claims 18 and 23 include the limitation, "generating a set of 2D reconstructed images ... correspond[ing] to perturbations from said initial position along fewer than six degrees of freedom." New claim 33 includes the limitations, "generating a first set of 2D images and a second set of 2D images ..., wherein each of the first set of 2D images and the second set of 2D images correspond to perturbations from said initial position along fewer than six degrees

of freedom." As discussed above, the combination of Grzeszczuk and Bova fail to teach or suggest such limitations. Therefore, Applicants submit that claims 18, 23 and new claim 33, and their corresponding dependent claims, are also patentable over the combination of Grzeszczuk and Bova.

Accordingly, Applicants respectfully request that the rejection under 35 U.S.C. § 103(a) be withdrawn.

Conclusion

Applicants respectfully request the withdrawal of the rejections and submits that pending claims 8-38 are allowable over the presently cited art. Applicants respectfully request reconsideration of the application.

In view of the above remarks, a specific discussion of the dependent claims is considered to be unnecessary. Therefore, Applicants' silence regarding any dependent claim is not to be interpreted as agreement with, or acquiescence to, the rejection of such claim or as waiving any argument regarding that claim.

If the Examiner determines the prompt allowance of these claims could be facilitated by a telephone conference, the Examiner is invited to contact Benjamin Kimes at (408) 720-8300.

Deposit Account Authorization

Authorization is hereby given to charge our Deposit Account No. 02-2666 for any charges that may be due. Furthermore, if an extension is required, then Applicants hereby request such extension.

Respectfully submitted,

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